REMARKS

The present Amendment amends claims 22-29 and adds new claims 30-35. Therefore, the present application has pending claims 22-35.

Applicants respectfully request the Examiner to contact Applicants' Attorney, the undersigned by telephone so as to discuss the outstanding issues of the present application prior to examination.

Claims 22-29 stand rejected under 35 USC §102(e) as being anticipated by Martins (U.S. Patent No. 6,950,123). This rejection is traversed for the following reasons. Applicants submit that the features of the present invention as now recited in claims 22-29 are not taught or suggested by Martins whether taken individually or in combination with any of the other references of record. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw this rejection.

Amendments were made to the claims to more clearly describe features of the present invention as recited in the claims. Particularly, amendments were made to the claims to recite that the present invention is directed to an object tracking method and object tracking apparatus for implementing the method for detecting and tracking an object in a picked-up image based on an image signal acquired by an imaging unit.

According to the present invention the object tracking method includes (a) producing a template image cut out from the image acquired from the imaging unit so as to include a part of the object, (b) conducting a template matching by calculating correlations between a present image from the imaging unit and the template image, detecting a position of a part of the present image matched with the template image, and updating a position of a

current template image by the detected position, (c) detecting an image changing area between at least two frames of images picked up at different time points by the imaging unit, (d) correcting the detected position of the object to a new position in which the image changing area is detected in a manner different from the detecting of a position of the part of the present image matched with the template image according to the template matching of the step (b), and (e) updating a template image by an image output as a new template image based on the updated position of the object, wherein the step (b) to the step (e) are repeatedly executed while tracking the object.

The above described features of the present invention now more clearly recited in the claims are not taught or suggested by any of the references of record whether taken individually or in combination with each other. Particularly, the above described features of the present invention as now more clearly recited in the claims are not taught or suggested by Martins whether taken individually or in combination with any of the other references of record. Therefore, Applicants respectfully request the Examiner to reconsider and withdraw these rejections.

Martins merely discloses that an estimation most matching with a hypothesis is selected as a consensus track point and that the MCMC technique is employed as the hypothesis (see col. 6, lines 55 – 65). That is, the matching performed by Martins means that points obtained by a hypothesis and an estimation are determined to be close to each other.

Martins does not teach or suggest the correlation between images each formed by plural pixels as in the present invention. In fact there is no teaching or suggestion in Martins of an expression such as correlation.

Although the MCMC technique as disclosed in Martins is used to calculate an expected value of a probability function by using the Markov Chain model as the probability distribution, the value may become large when there is the correlation between the probability density and the probability distribution. Thus, this type of correlation is quite different from the correlation between images as in the present invention.

Further, Martins teaches a method for simultaneously tracking multiple bodies in a closed structured environment. Martins teaches in col. 6, lines 1-5 that the field template 224 is applied to clip the region of interest from the difference image. This teaching of Martins means that an image is simply cut out to a shape of a playing field. Thus, this operation does not correspond to an operation of template matching by calculating correlations between a present image and the template image as in the present invention. In Martins, it is not necessary to perform the template matching since a simple cut out operation is performed.

The meaning of the template matching in the present invention is clearly described in the specification on page 6, line 23 to page 10, line 17. No similar description can be found in Martins.

Further, in Fig. 6 of Martins, the computation in the step 226 is neither the correlation calculation nor the template matching so that the difference is acquired from the field model 222 having no players created by using a plurality of frames and the current image 220. Therefore, Martins does not teach or suggest the step of conducting a template matching according to the present invention.

In the step of detecting an image changing area, it seems that the "image changing area" of the present invention may correspond to the "leaving the players clearly identified as blobs" described on col. 6, lines 2-3 in Martins, which does not correspond to the description on col. 6, lines 40-50 of Martins as alleged by the Examiner.

Martins discloses that the position of an object is searched within an ROI, that the position of the ROI is set based on a previous estimation (prior track), and that estimates of respective cameras are bound and a consensus track is drawn out also by using the historic consensus track (see col. 6, line 58 to col. 8, line 22).

Martins is similar to the present invention only to the extent that both use the "binding consideration". However, in Martins the subject to be bound is a track(s) detected by the ROI-based method as described on col. 7, lines 8-38. Thus, Martins does not teach or suggest the features of the present invention that a position detected by the template matching is corrected by a position detected by a method different from the template matching which can be directly detected from an image picked-up by an imaging unit.

Further, Martins teaches at co1. 6, line 58 to col. 7, line 7, that a present position of the object is computed by "visual inspection of the enhanced difference frame". Martins teaches at col. 7, lines 8-38, that the centroid of an Object's ROI is updated.

However, contrary to the Examiner's allegations, the "Object's ROI" does not correspond to the "template image" of the present invention in that the "template image" already corresponds to the "field template 224" as recited in the template matching. In fact, the "template matching" step is not

applied to the "Object's ROI". Therefore, Martins does not teach or suggest that the template image is updated in the detecting and updating step of the present invention as recited in the claims.

In the present invention, two types of algorithms (for template matching and difference oriented detection) are combined so that a position is independently detected. This is because the difference oriented detection is easily confused by a background having movement and a shadow and illumination (particularly at night), whereas the template matching is less susceptible to the foregoing causes because of performing the correlation calculation, which is therefore more suitable for the tracking.

As per the present invention, in the case of template matching, there may be a strong influence from a correlation value among the objects, as the template is updated in accordance with the previously matched position, so that whole objects cannot be overlooked. Further, as per the present invention, the difference method can correct a position detected by the template matching because a position where a difference (or object) is always present is attracted and a correction amount is restricted.

Thus, according to the present invention using the two types of algorithms is much better than using only one of the algorithms. Accordingly, the present invention has an advantage over that taught by Martins of enhanced tracking accuracy.

In contrast, Martins describes the median filtering (threshold difference in col. 6, line 18) with respect to the field model 222 and the "update track 250" (Fig. 7) with respect to "Object's ROI, which are position detectable algorithms. However, the field model is fixed if it is obtained once because a

playing field does not move. On the contrary, the "Object's ROI" is such a player. An object to be detected is quite different. As a result, there is no relationship between the detected results to be corrected with each other.

Thus, Martins fails to teach or suggest (a) producing a template image cut out from the image acquired from the imaging unit so as to include a part of the object, (b) conducting a template matching by calculating correlations between a present image from the imaging unit and the template image, detecting a position of a part of the present image matched with the template image, and updating a position of a current template image by the detected position, and (c) detecting an image changing area between at least two frames of images picked up at different time points by the imaging unit as recited in the claims.

Further, Martins fails to teach or suggest (d) correcting the detected position of the object to a new position in which the image changing area is detected in a manner different from the detecting of a position of the part of the present image matched with the template image according to the template matching of the step (b), and (e) updating a template image by an image output as a new template image based on the updated position of the object, wherein the step (b) to the step (e) are repeatedly executed while tracking the object as recited in the claims

Therefore, Martins fails to teach or suggest the features of the present invention as now more clearly recited in the claims and as such does not anticipate nor render obvious the claimed invention. Accordingly, reconsideration and withdrawal of the 35 USC §102(e) rejection of claims 22-29 as being anticipated by Martins is respectfully requested.

The remaining references of record have been studied. Applicants submit that they do not supply any of the deficiencies noted above with respect to the references utilized in the rejection of claims 22-29.

As indicated the above the present Amendment adds new dependent claims 30-32 each depending on claim 24 and new dependent claims 33-35 each depending on claim 26. Thus, new claims 30-35 recite the same features recited in claims 24 and 26 shown above not to be taught or suggested by any of the references of record whether said references are taken individually or in combination with each other. Therefore, new claims 30-35 are allowable over the prior art of record for the same reasons as claims 24 and 26.

In view of the foregoing amendments and remarks, applicants submit that claims 22-35 are in condition for allowance. Accordingly, early allowance of claims 22-35 is respectfully requested.

To the extent necessary, the applicants petition for an extension of time under 37 CFR 1.136. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of MATTINGLY, STANGER, MALUR & BRUNDIDGE, P.C., Deposit Account No. 50-1417 (500.43348X00).

Respectfully submitted,

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